

## **Abstract**

## **Introduction**

## **Physics Motivation**

*The THIRD Neutrino  
Neutrino Oscillations*

## **Physics Calculations**

*Production of Prompt Neutrinos*

Primary Source – Charm Decay

Secondary Sources

*Neutrino Interactions*

Charged Current Interactions

Neutral Current Interactions

*Expected Rates*

Protons on target

Target Masses

Solid Angle Acceptance

Detection Efficiency

## **Prompt Neutrino Beam**

*Design Requirements*

*Concept*

Target

Muon Sweeping

Shielding

*Engineering Designs*

Target (Beam Dump)

Muon Sweeping

Muon Absorption

Soft Component Shielding

*Performance*

Muon backgrounds

Soft e, $\gamma$  backgrounds

## **Hybrid Emulsion Spectrometer**

*Philosophy (Method)*

*Historical Background*

*Design*

Resolution Requirements

Particle ID

Energy/momentum measurements

*Performance*

Tracking efficiency

Momentum resolution

Energy resolution

## **Data Taking**

### ***Calibration with PW5 Muons***

### ***Neutrino Interaction Triggers***

- Trigger Rate
- Data Acquisition
- On-line Analysis

## **Data Analysis**

### ***Alignment and Calibration***

- Emulsion
- Fiber Tracker
- Trigger Counters
- Drift Chambers
- Muon ID
- EM Calorimeter
- Magnetic Field

### ***Emulsion Processing***

### ***Event Location (Spectrometer)***

- Raw Data Processing
- Pass 1 Stripping
- Visual Scan Selection
- Track Finding
- Vertex Prediction
- Refitting

### ***Event Location (Emulsion)***

- Introduction
- Scanning Hardware
- Scanning Methods

### **CS Scan**

### **Net Scan**

### ***Event Analysis***

- Event Distributions
- Determination of Event Parameters
- Event type likelihood analysis

## **Monte Carlo Analysis**

### ***Neutrino Event Generator***

- Deep Inelastic (Lepto 6.1)
- Quasi-elastic

### ***Generated Distributions***

- Neutrino Types
- Energy Spectra
- Tau Lepton Distributions

### ***Hybrid Emulsion Spectrometer Simulation (Geant)***

- Descriptions

Distributions (Comparison to Data)

## **Physics Results**

### ***Composition of the Prompt Neutrino Beam***

#### ***Nu Tau Interactions in Bulk Emulsion***

Measured Event Rates

Measured Event Distributions

Acceptance Corrections

Comparison to Predictions

#### ***Nu Tau Interactions in ECC Targets***

Measured Event Rates

Measured Event Distributions

Acceptance Corrections

Comparison to Predictions

#### ***Neutrino Production of Charm in Emulsion Targets***

Measured Event Rates

Measured Event Distributions

Acceptance Corrections

Comparison to Predictions

#### ***Determination of $\sigma_{charm}(x_f, p_t)$ from the observed neutrino energy spectrum***

Measured Energy Spectrum

#### ***Measurement of the $\nu_\tau$ magnetic moment***